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REGULATION BY DEMAND: A NEW INSTITUTIONAL  
APPROACH TO THE NATURAL MONOPOLY PROBLEM

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**SOCIAL SCIENCE WORKING PAPER 342**

September 1980

## ABSTRACT

Regulation-by-demand, a new institutional design for the natural monopoly problem, is based on the demanders' participation in the industry's regulatory process. Conventional rate of return regulation fails to implement allocative efficiency, and is subject to significant limitations and distortions in its information processing which prevents the preferences from being disclosed. It is suggested that if a utility function that encompasses quality characteristics is considered, the failures in the industry's performance are even more severe than what is usually acknowledged. Regulation-by-demand provides allocatively functional incentives for reliable information processing and for efficient performance of the industry. It has significant advantages of institutional flexibility if the industry loses its natural monopoly properties.

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INTRODUCTION

Criticism on the effects and failure of rate of return regulation is numerous. It is, therefore, surprising that the literature is very scarce with respect to new institutional designs to avoid these failures. The only fundamentally new approach, so far, for an institutional redesign of natural monopoly industries is the franchise bidding concept, with some varieties.<sup>1</sup>

The main feature of the franchise bidding proposal is the preservation or restoration of invisible hand forces during the pre-contract process. After a competitive bidding among possible suppliers, the demanders grant a "right to serve" to one of them, who promises to be the best choice for guaranteeing them a "right to be served" for reasonable prices and performance.

Williamson<sup>2</sup> provides a detailed critical review of three varieties of the franchise bidding proposal, applying the contractual relations framework<sup>3</sup> to the stipulations and contracting in a franchise bidding system. He convincingly suggests that the bounded rationality that the parties are subject to, prevents them from

reaching allocatively efficient contracts because of the involved contingencies. The basic reason is that the introduction of invisible hand forces consequently requires the admissibility of opportunistic behavior of the parties once contingencies occur during the time the serving contract covers. In order to deal with contingencies and opportunistic behavior, the parties have to consider in advance which would be the appropriate complexity of the contract and the length of time to cover.

Short-term contracts with frequent renegotiation<sup>4</sup> result in severe problems of idiosyncrasies<sup>5</sup> of the invested capital and of the labor and management of the incumbent firm. These idiosyncrasies restrict the demanders' option of changing their supplying contractors, which significantly weakens the invisible hand forces. Further inefficiencies can be expected from the resulting incentive structure of the supplying firm which is interested only in short-run returns.

Simple long-term contracts leave the risks of the occurring contingencies to the parties. This has not only distributional implications, but also adverse allocative implications. Long-term contracts with increased complexity are characterized by increased future contingencies covered, and entail increasingly detailed stipulations for specific contingencies. The negotiations of such contracts require a great deal of information processing and incur high transaction costs, which may even exceed the possible accruing advantages of the contract itself.

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\* Research and publication of this paper is sponsored in part by the American Council of Learned Societies.

The transaction cost problems prevent workability of franchise bidding systems for most of the natural monopoly industries, with the possible exception of those where low idiosyncrasies make frequent short-term contracting feasible.<sup>6</sup>

As the Williamson analysis is so striking, the franchise bidding design need not be discussed any further in this paper. However, it shall be noted that his criticism refers to the same conceptual framework as this paper does. "Bounded rationality" and "transaction costs" are based on limitations and costs of the participants' information processing, which is the central concept in the following pages.

It is generally assumed in the economic discussion of natural monopolies that the demand side has some sort of organization (either cartel like or by political representation) that enables it to act as one party in the negotiation process or in post-contractual intervention. But the method of reaching such a one-party behavior that is still representative for the preferences of a number of demanders is far from self-evident.

It entails severe problems of communicating and evaluating individual demand characteristics, their aggregation, and resolution of conflicting situations, especially when a large number of demanders is involved, as is in the public utilities cases.

As the individual demand characteristics are often not known, not well-defined, and not operational, the problem increases with limited information processing capacities of the demanders. The resulting allocative problems further increase with the extent of

heterogeneity of the demanders' preferences, and the extent of subadditivities in the cost functions. These problems are neglected in the discussion on regulation and franchise bidding.

It is suggested here that these problems are responsible for a great deal of the regulatory failures and, more important, that most of the suboptimalities in the industry's performance are not disclosed for the same reasons that they appear: the information processing is systematically distorted. Economist-observers have no independent sources of information that enables them to define optimality per se in order to measure the empirical performance.

Economists do not have such a per se measure in competitive markets either, but they trust their theoretical conclusions that the system will come out with optimal results, if some structural conditions are met. Basically the same methodology is applied here: we examine the structural conditions, find they are not met, and predict that optimality will not be reached (or only by chance in some peculiar cases).

The following two main sections of this paper focus on the information processing and incentive structure of institutional designs for natural monopolies. Section 2 applies the information processing framework to the regulatory system prevailing in the United States. Section 3 proposes a new institutional design for natural monopolies, the regulation-by-demand concept, and suggests that its incentive and information processing properties result in significantly improved allocative performance.

### INFORMATION PROCESSING AND CONVENTIONAL REGULATION

The regulatory commissions practically confine themselves to price regulation--oriented at a "far rate of return"--and market entry regulation, with the effects widely discussed in the regulatory literature. The main issues are:

cost slack--a company loses its incentives for cost minimizing production if the regulatory commission grants it a quasi-quarantee to earn a profit that is a fixed share  $r$  of its invested capital  $I$ ;

Averch-Johnson effect--when  $r$  exceeds comparable capital market return and the amount of  $I$  is the only remaining parameter for the owners of the firm to increase absolute profits, they will choose the production function with the highest requirements for capital, which is not said to be the cost minimizing;<sup>7</sup>

wrong price structure--a company protected from competitive market forces has decreased incentives to set a price structure that is allocatively efficient; regulatory umbrella--the regulatory commissions are prone to protect the incumbent firm against market entry and, therefore, remove further invisible hand forces; institutional inflexibility--the commissions tend to maintain regulatory protection beyond the point where the constituting average-cost/demand properties have changed the competitive lines might be feasible; and

capture effects--the commissionaires' independence from allocatively founded incentive structures gives way to dysfunctional behavior, such as "close cooperation" with, and

"career opportunities" in, the regulated firms.<sup>8</sup>

The quality aspects which are a very important issue in competitive market processes seem to be widely neglected. Although a management facing competition has a much better informational basis than a monopolist's has, they very often find themselves forced by the market results to change the quality characteristics of their products. Do we have any evidence that the regulated firm's quality decisions are efficient? Are we asking questions only if we feel that answers are available by applying our usual analytical tools, or are we subject to the same informational limitations as the supplying decision-makers themselves?

In order to understand the information processing problems to be solved in an institutional system for natural monopolies with autonomous and selfish decision units, we start with some general considerations on information processing economics. We apply a simple framework to competitive markets, before we analyze the conventional regulatory system and, finally, the regulation-by-demand design. Although it is claimed that the theoretical framework and the verbal discussions hold for one- as well as for multi-product firms, and for homogenous as well as for heterogenous demanders' preference functions, this introductory paper, for reasons of simplicity, confines itself in the algebraic and graphic presentation to one-product firms (the one product can be thought of as a whole variety of products with fixed internal relations) and to preferences that allow unambiguous aggregation.

### Information Processing

Every information processing (intra-unit as well as inter-unit) is costly, either in terms of money or in terms of personal efforts, stress of thinking etc, and is, therefore, subject to cost-benefit considerations of the units (demanders, management, regulatory commission, etc). Incentives to actually process information are given by the units perception that the benefits will exceed their costs and will therefore:

- increase with the units information processing capacity<sup>9</sup> and specific cognitive structurization,<sup>10</sup>
- decrease with the complexity of the problem<sup>11</sup> and the amount of (especially irrelevant) information to be processed,
- increase with the relevance of the issue for the units objective function, and
- increase with the units' judgment, if a certain amount of information processing really effects his outcome.

Besides the seemingly quantitative aspects of processing information, we also have to examine their incentives to process information truly and correctly. This shall be referred to as the reliability of information processing.

The mentioned information processing capacity of the unit, however, is also generally variable, at least in the longer run, depending on the unit's cost-benefit considerations. The capacities and its flexibilities are very different among the units as the respective cost- and benefit-functions are.

On one side, managements of corporate firms generally have a large flexibility to adjust their information processing capacities by adequate staffing and setting up organization patterns and equipment. Even in the short-run or for adhoc problems, they will normally be able to rearrange their workload in order to have more capacities for this particular problem. With regard to "relevance" and "effectiveness", we can assume that the supplying firm is able to adjust their information processing capacities to process as much information as they consider most profitable -- to come up with the "right" decision or the appropriate information output to other units. The same will be true for those firms on the demand side, where the pertinent product has significant relevance for their business figures.

On the other side, if the demanders are consumers (households), their information processing cost-benefit considerations have a quite different result. Consumers, as single units, have very limited capacities, which they have to share among all the different issues they have to or choose to deal with. As information processing has significant scale economies within non-heterogenous groups of units, the consumers may organize to set up a common information processing device with sufficient capacity. Such actions on a voluntary basis are subject to severe organizational and free rider problems. Empirical evidence shows that they are not workable for "normal" situations, but may only have effect in extreme and one-issue cases.

### A System's Response to Preferences

From the allocative viewpoint, the demander is supposed to evaluate and process his preferences to the system's decision-makers (namely the managements of the supplying firms and, in case, the regulatory agencies).

In addition to the demanders' information processing problems (and in interdependence with them), the systems performance in receiving and processing the demanders' signals and responding to them allocatively adequately varies widely, which is mostly due to different incentive patterns.

These aspects are incorporated in Figures 1, 2, 3, and 5 to show different systems' responses to demanders' preferences over the respective information processing system. The horizontal axis is "Expected Allocative Value of Information", EAVI, and is scaled in units of (potential) information that is allocatively worth being transferred. A situation will be located more to the right on the EAVI-axis:

- the stronger a demander feels a need for a certain product or policy, according to his preference structure and the status-quo, and
- the more demanders feel this kind of need.

The vertical axis gives the system's response to these needs. The dotted line NN' divides the "normal" or routine cases from the extraordinary or extreme cases, which are characterized by a very strong need of many demanders and which do occur very seldom. The

level  $R_{\min}$  represents the threshold sensibility of the system under which responses are considered neglectable by the system. The line  $S_0$  represents the theoretical "perfect response" in an optimal system and is used for comparisons only. For example, let's consider an arbitrary political system and let the issue be an interest that some individuals share. Assume that the information processing of the individuals alone does not get response in the system, because their individual information processing and/or political influence are too small. If the importance of the issue now is considered bigger for the allocation, and it finally becomes an outstanding problem, the individuals may succeed in forming a workable group to increase information processing and gain political influence. This is represented by  $S_1$  in Figure 1. While the issue is in the normal EAVI-range, the individuals anticipate the non-response, and their information processing will be significantly smaller than it would be in a responding system. This gives the framework for the institutional discussion of the following pages.

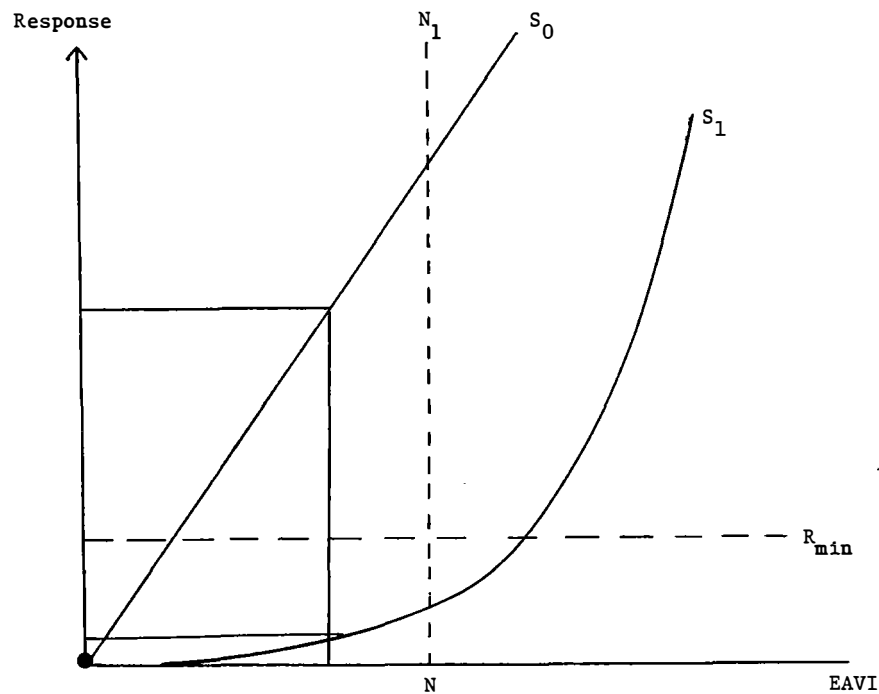
The demanders' preferences are assumed to be given by a utility function

$${}_j^U = {}_j^Y[{}_j^k(p), {}_j^k(q^1), \dots, {}_j^k(q^L)] \quad 1 \leq 1 \dots L \quad (1)$$

where  $p$  is the price and the  $q^1$  are the different non-price characteristics of the product. The  ${}_j^k(p)$  and  ${}_j^k(q^1)$  express the demander  $j$ 's relative criteria of price and non-price characteristics (the importance for his objective function; utility function). If we consider the complexity involved in the availability or non-



FIGURE 1



availability of certain characteristics vectors, it is immediately clear that no demander could ever process all the information necessary to fully represent his preferences, or even give a set of operational criteria that holds for more than one point. Since the demanders' information processing capacities are rather limited, the problem for the institutional system comes down to asking them the "appropriate questions" in order to get the preference revealing information that is relevant for the supply decisions and that will be processed "reliably enough" by the demanders. Or: how does the system deal with the informational imperfections that are inevitable? For example, a demander might be able to give an overall preference order  ${}_jU_1 > {}_jU_2 \dots$  between two or more products  $i$  ( $i = 1, 2, \dots$ ), but is not able to identify the main criteria  $jk$  that actually effect this judgment. The first task is much easier to carry out than the latter is, and it reveals some information about the demander's criteria. Whereas, if the demanders' task were the latter and a higher information processing level would be required in order to participate in the allocative "preference articulation game," more and more demanders could not participate and the results would be systematically distorted. The problem of incomplete preference articulation will be a basic one for all institutional designs for allocation, but its degree and especially its impact on the resulting allocative performance will significantly vary.

In competitive markets the demanders actual information processing for revealing preferences to the supply side is identical with the one to choose the expectedly best product among others. Even

if the demander does not know that he is participating in allocative information processing, his choice problem provides incentives for reliable information output.

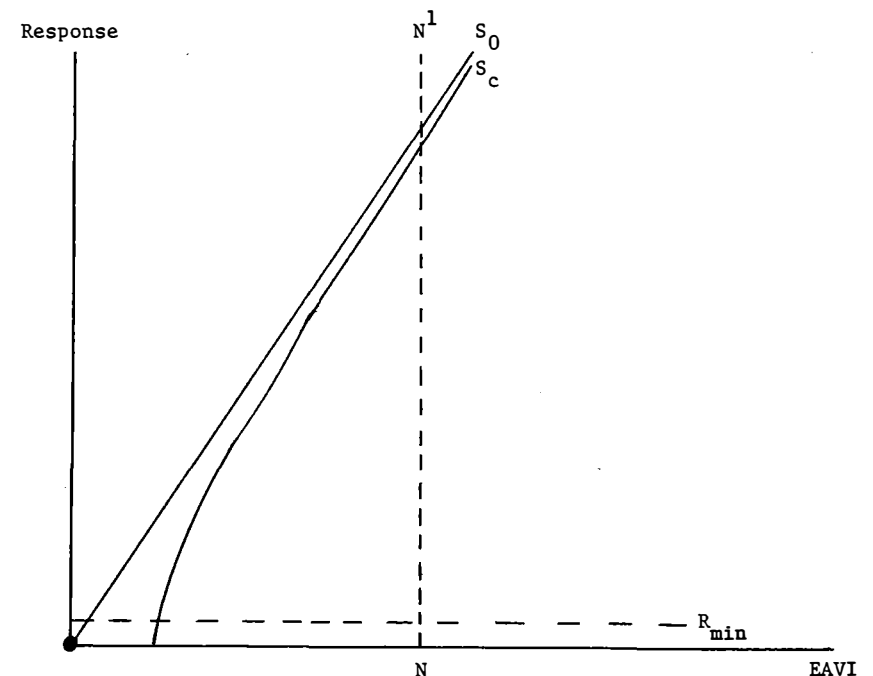
The supplying firms have strong incentives to process and to substantiate the obtained information reliably, because their future profits depend on an accurate perception of and adjustment to the demanders' preferences. This determines their interpretation of signals from simplified choice processes and from subsidiary sources (for example marketing research). Despite the well-known consumer information problems and distorting advertising, it can be expected that the elements of the objective functions will be relatively well processed by the competitive system. This is indicated by  $S_c$  in Figure 2. The informational threshold is low, first because of the described incentives, and, second, because of the decentralized decision-making and the low-scale production units.

#### Information Processing and Response in Regulated Natural Monopolies

In regulated natural monopolies the market process does not provide nearly the same amount and the same quality of information as competition does. The demanders' choices are drastically reduced:

- within the given technological field (which by definition has natural monopoly properties) to a few (or even no) varieties provided by the same unthreatened monopolist, and
- between technological fields (intermodal competition) by substitutional gaps to other technologies in the judgment of each demander.

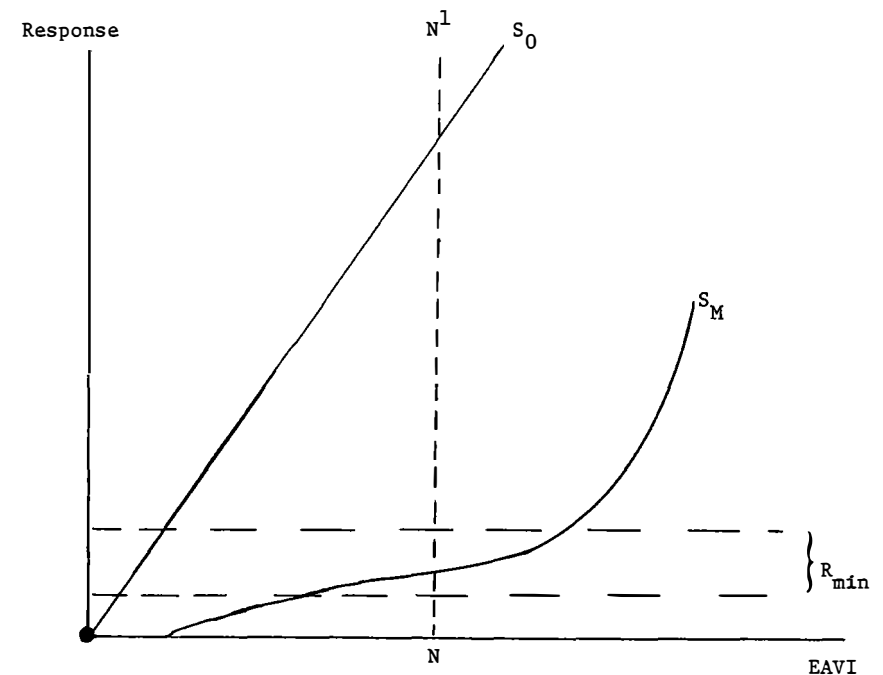
FIGURE 2



This is indicated in Figure 3 with the response function  $S_m$ , the left slope of which is due to variety-choices, and the right one is due to increasing choices of substitutional modes (other technologies).

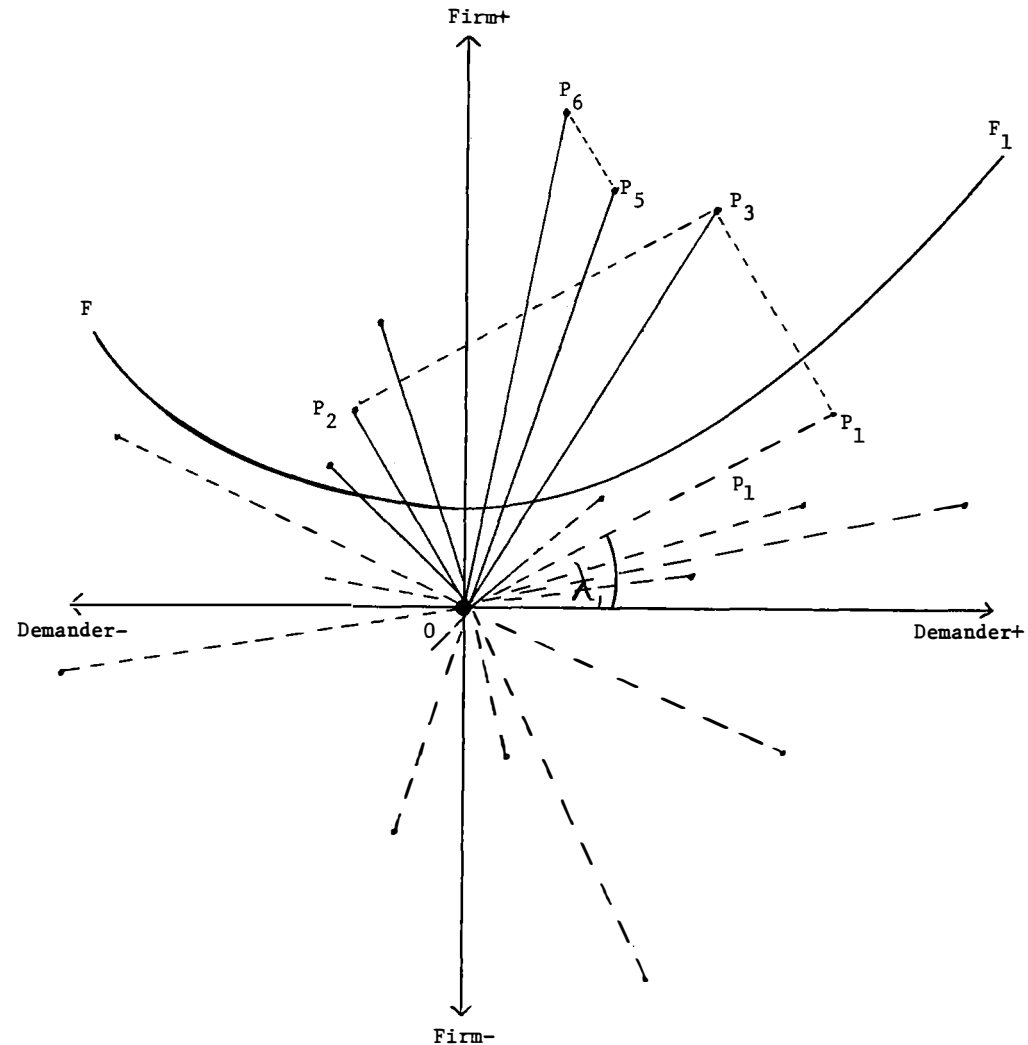
As the market itself does not provide enough information, we have to look at the non-market information processing of the regulatory system, and this is going to be the crucial point. We start with the management's role and then include the regulatory commissions. The management's information processing in natural monopoly industries is subject to basically the same incentive patterns that rule their material decisions. Since the management has its own (not at allocative efficiency oriented) objectives (profit/rate-base) and rather limited obligations to make their information available to observing third parties or even regulatory agencies (not talking about information that might require extra information processing efforts) they will reveal information about demanders' preferences only if they fit into their policy. Furthermore, they will make information processing efforts only if they expect the results to serve their interests within the regulatory environment. The demanders anticipation of this situation of the protected monopoly will remove their incentives to voluntarily provide information at their own cost, because they do not expect effectiveness. Therefore, the firm's large and highly specified information processing capacity is dysfunctionally monopolized, and the preference transfer systematically distorted.

FIGURE 3



The regulatory authorities practically confine their information processing to checking informational results obtained and policy options submitted by the firm. The regulatory agencies do not oblige a regulated firm to offer a new product or service, or apply a new technology, first, because of legal barriers and, second, because of their own informational limitations. They do not carry out their own investigations on demanders' preferences, new technological developments, or new possibly available products. We will depict this in Figure 4 for possible movements in a regulatory procedure. The point 0 gives the status-quo, and the axes show the benefits of a certain outcome of the procedure for the firm and the demanders, respectively. Lets consider a certain number of radii going through 0, each determined by an angle  $\gamma$  and a length  $p$ , where the  $\gamma_i$  and  $p_i$  are given by a random process. Lets assume that the set of resulting points  $P_i$  represent the outcome of available options in the regulatory process—without any regard to whether these options and their results are known to any of the participants (management of the firm, regulatory commission) or not. The area of advantageous options for the firm (initially the whole area north of the horizontal axis) is restricted by some further considerations if the firm has to obtain the consent of the regulatory commission. The regulatory procedure incurs costs and risks to the firm. The firms position to dominate, or even to monopolize, the systems information processing enables it to either disclose the availability of a certain option to the commission and the public, or to keep them undisclosed. This restricts the options that are discussed to the firm's advantageous

FIGURE 4



ones, except in simple rate cases. The firm knows which information the commission is able to get according to the commission's capacities and its legal restrictions (for example revenue and cost figures) and which not (for example all not realized points of hypothetical cost and demand functions). Therefore, the firm will only reveal options if they are north of a line  $FF'$ . The upward slope is given by the following consideration: assume the firm detects an option  $P_1$  southeast of  $FF'$ . They will expect that they can present a package of  $P_1$  and  $P_2$  to reach a point  $P_3$ , assuming that the commission will either not detect the separate availability of  $P_1$  and/or that, in case they do, they will not coercively enforce  $P_1$  separately. Such a strategy is not promising in simple rate cases, but it is in more complex issues.

A firm's given application concerning an option  $P_5$  will not necessarily truly reveal the results of a firm's information processing, since the commission is subject to limitations in screening the application. Besides lack of technological knowledge, this will be due to ignorance about demanders' utility functions. Thus, instead of  $P_5$ , a point  $P_6$  may be likely to occur.

The restricting legal framework for the commissions activities, and their low budgets that prevent them from establishing efficient information processing capacities themselves, weaken the commissions position in conflicting cases. It undermines their independence, and subjects them to the influences of interest groups. Regulatory commissions can be expected to adopt a "muddling-through-behavior" to avoid trouble with the powerful groups involved. These

groups are likely to be the regulated industries themselves and, in some cases, especially large demanders. Consumer-demanders are not likely to get effective response in the regulatory process, except in outstanding cases.<sup>16</sup> Thus, we propose that the demanders' response through regulatory commissions is represented by  $S_1$  in Figure 1. (see page 11)

A sketchy result of the information processing and response in a regulated industry is given in Figure 5. The response is given by two distinct graphs, subject to the firms expectation if the processing of a certain kind of demand information is or is not advantageous for their objectives, following the analysis of Figure 4. Response function  $S_7$ : if the firm regards it as advantageous, it will use its own information processing capacities to either directly implement it, or to get the commissions approval. Response function  $S_8$ : if the firm does not regard it as advantageous, the response is subject to all detrimental factors discussed in the preceding pages. This will widely prevent its effectiveness in "normal" cases, if we consider price adjustments according to the rate of return formula quasi-automatic.

#### The Allocative Results of Regulation in a Characteristics Space

After having discussed the information processing problems, the expected results shall be shown in a graphical presentation for a one-product output. Figure 6 encompasses two different product characteristics on the vertical and horizontal axis with increasing utility values along the axes. Lets assume that the other product

FIGURE 5

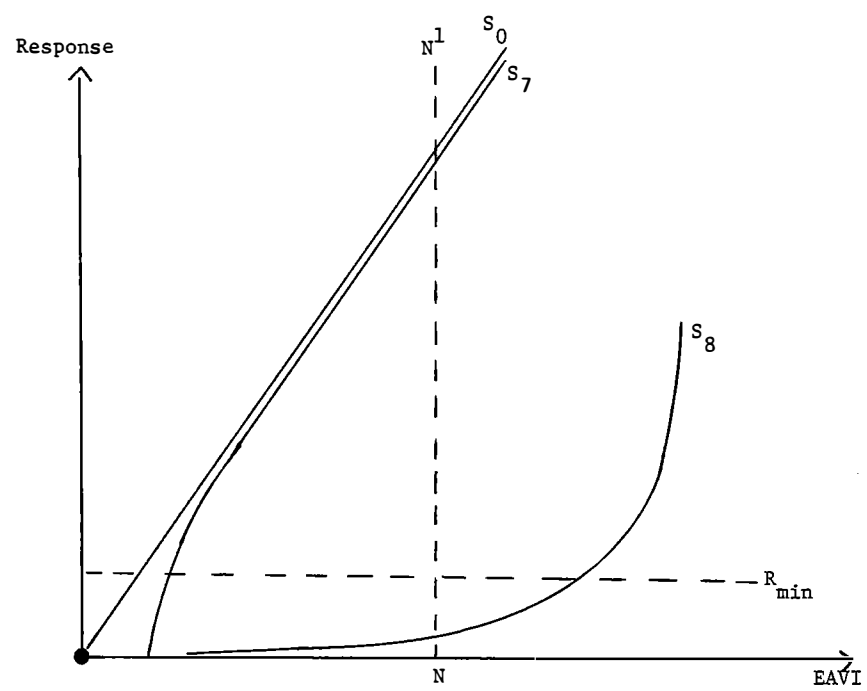
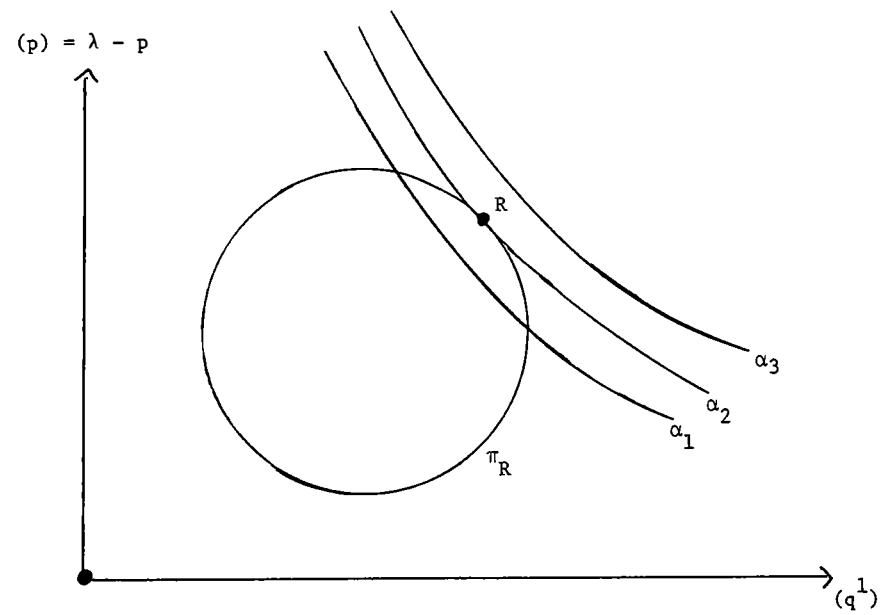


FIGURE 6



characteristics are constant. The vertical axis is the characteristic "price" ( $p$ ) (high prices  $p$  have low utility values ( $p$ ):  $(p) = \lambda - p$  for a constant, positive and large number  $\lambda$ ) and the horizontal axis is an arbitrary relevant quality characteristic ( $q^1$ ).

$R$  is the presently effectual point for the firm's product, with the firm's (and commission's) assumption and/or assertion that the set of iso-utility lines  $\alpha_1, \alpha_2, \dots$  represent the prevailing preferences of the demanders (with  $U(\alpha_1) < U(\alpha_2) < \dots$ ) and that  $\pi_R$  is the firm's pertinent iso-profit locus, given the set  $\alpha$ . The profit is determined by the regulatory constraint

$$\pi_R = I \cdot r \quad (3)$$

and  $\pi_R$  is a circular graph in the  $p/q^1$ -space.

Generally, the profit is given by the average costs  $c$ , price  $p$  and quantity  $x$ :

$$\pi = x \cdot (p - c) \quad (4)$$

The quantity  $x$  consists of the quantities  ${}_j x$ , each demander  $j$  decides to purchase,  $x = \sum_j {}_j x$ , following

$$\left. \begin{aligned} {}_j x &= 0, \text{ if } a_j U^* \geq \int_j U \\ {}_j x &> 0, \text{ if } a_j U^* < \int_j U \end{aligned} \right\} \quad (5)$$

with  $x$  monotonously non-decreasing as  $(\int_j U - j U^*)$  increases. ( $j U^*$  gives a minimum utility for  $j$  under which he does not purchase our product). With the quality characteristics in our utility function (1) constant by assumption except one  $q^1$ , we have

$${}_j U = \gamma[{}_j k(p), {}_j k(q^1)] \quad (6)$$

with assumption

$$\frac{d_1 k(q^1)}{d_1 U} \geq 0, \text{ if } \frac{d_2 k(q^1)}{d_2 U} \geq 0 \text{ for all } j = 1, 2, \dots \quad (7)$$

and (5), the demand function is

$$x = \theta(p, q^1) \quad (8)$$

The average costs are a function

$$c = \psi(x, q^1) \quad (9)$$

first because of the natural monopoly condition  $\frac{dc}{dx} < 0$ , and second, by the assumption that each quality of the product incurs its own cost function.

With (8), (9) and (3), (4) becomes

$$r \cdot I = \pi_R = [\theta(p, q^1)] \cdot [p - \psi(\theta(p, q^1), q^1)] \quad (10)$$

With  $\pi_R$  constant, we have quadratic terms for  $p$  and  $q^1$ , which is a circular graph in the  $p/q^1$ -space.

The iso-utility lines  $\alpha$  are represented by consumer surplus

$$U(\alpha) = \int_p^\infty p \cdot \theta(p, q^1) dp \quad dq^1 \quad (11)$$

With

$$\frac{dp}{dg^1}, \frac{dg^1}{dp} < 0, \quad (12)$$

it is reasonable to confine the graphical analysis to the northeast section of the  $\pi$ -lines, the efficiency border.

Reconsidering our discussion on regulatory failure,  $R$  in Figure 6 will not be the welfare optimal point. The cost slack argument suggests the production costs are higher than necessary. This means there will be a cost function  $\psi^1$  with lower costs ( $c' < c$ ). Replacing the costs terms in (10),  $[\theta(p, q^1)]$  decreases and the efficiency border shifts to the northeast, reaching a higher utility-level. Figure 7 shows that  $R_2$  can be reached with constant  $q^1$ , and  $R_1$  with other choices for both  $p$  and  $q^1$ . For the efficiency border, the same effect would occur if the Averch-Johnson type input distortion would be avoided.

For a discussion of the effects of information processing failure, let  $R_{\alpha\alpha}$  in Figure 8 be the realized point after a regulatory procedure held for adjusting the price after changes in costs according to the rate of return condition. This point has been reached after a move from either  $R'$  or  $R''$ , depending on the former cost situation. Lets consider here a price increasing application following increased costs ( $R' \rightarrow R$ ). Moving to  $R$  is a reasonable decision only if the assertion is true that the  $\alpha$ -set actually represents the demanders' preferences, and that  $\pi_R$  is the firm's actual iso-profit locus to the  $\alpha$ -set. But if, for reasons discussed broadly above, the preferences are better represented, lets say, by the  $\beta$ -set instead (with  $U(\hat{\beta}) = U(\alpha_1)$ ),  $R_{\alpha\alpha}$  will be suboptimal. Figure 8 and 9 show this for two different iso-profit assumptions. In Figure 8, the  $\pi$ -line is the same for the  $\alpha$ -set as well as for the  $\beta$ -set, with the optimal point  $R_{\beta\alpha}$ . Figure 9 encompasses the more realistic assumption that a different preference structure (over the different

FIGURE 7

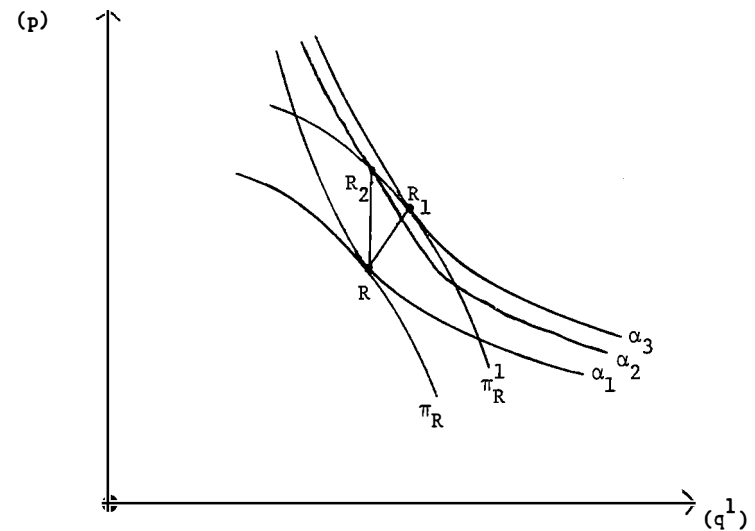




FIGURE 8

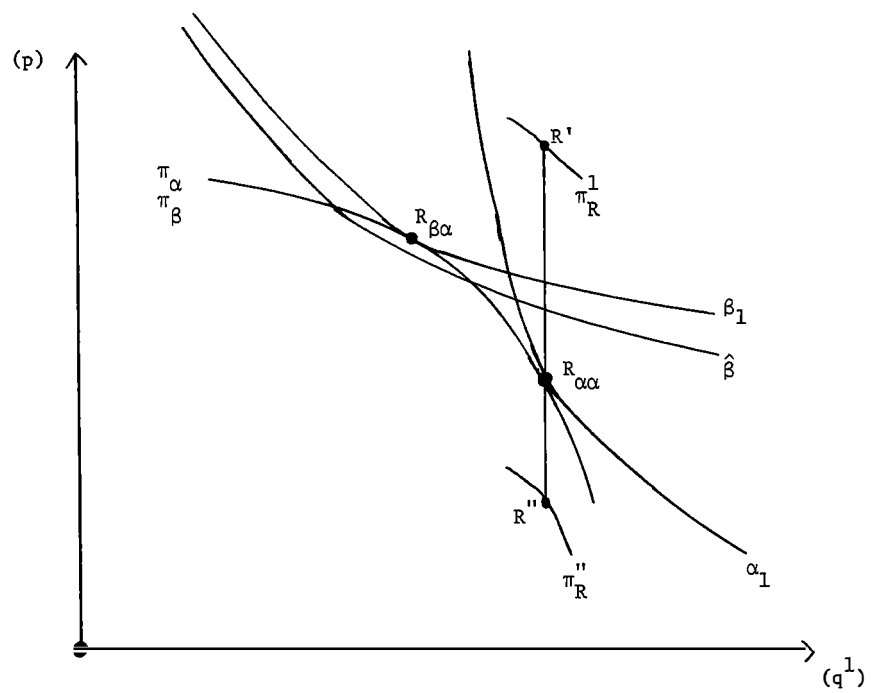
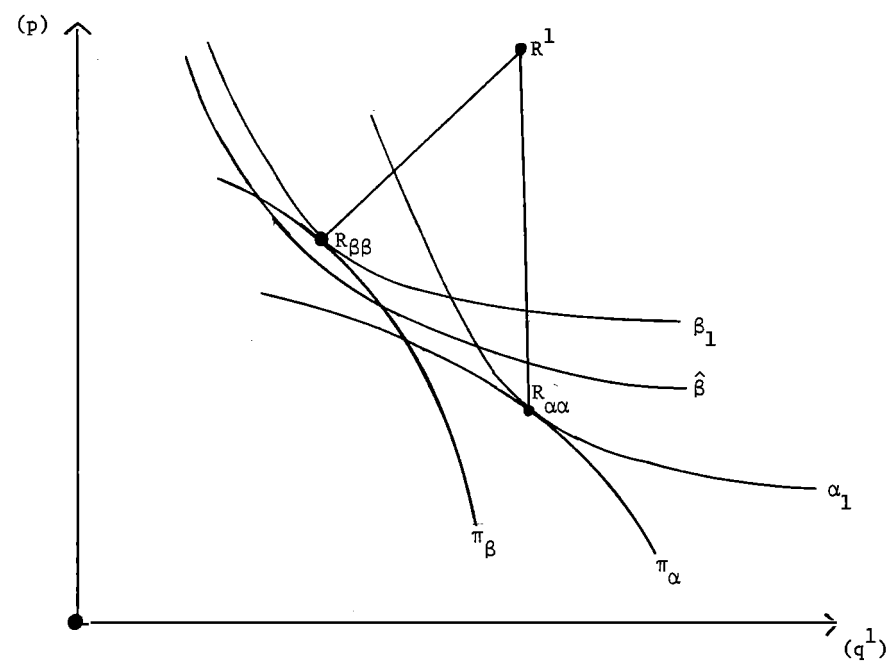


FIGURE 9



demand function  $\theta_\beta(p, q^1) \neq \theta_\alpha(p, q^1)$  causes a different iso-profit curve  $\pi_\beta$ . The optimal point then is  $R_{\beta\beta}$ .

A prediction if a given situation is subject to lower quality or higher prices than the allocatively optimal situation, cannot be derived from this analysis. This depends upon the specific shape of the iso-utility lines given by the demanders' preferences. An analytical observer here suffers from the same informational limitations of the institutional design as the regulatory commission. But it can be derived that the assumption the system will produce efficiently according to the preferences is unfounded. The system is insensitive to preferences and problems of product characteristics unless they grow to outstanding issues. The limitations and failures in information processing leave the commission with entry decision problems that are too big for them. They will not be able to reasonably predict the outcome of a certain change of the industry structure and performance out of their own information processing and founded judgment. Being dependent upon the industry's provision of information, they will tend to protect the status-quo which results in institutional inflexibility.

#### THE REGULATION BY DEMAND DESIGN

The regulation-by-demand design approaches the specific informational and incentive conditions of natural monopolies directly, without trying to conserve institutional elements that might be important in competitive environments. However, in order to allow institutional transition between regulation and competition if the

constituting economic conditions have changed, the "firm", as the productive unit with its internal organizational structure, is still the same. The fundamental change occurs in the firm's objective function and incentive structure. This is the starting point of the institutional analysis, and determines the elements and rules within the design, not the other way round. For example, profit-oriented decision-making by private owners of the firm becomes allocatively obsolete as soon as the incentives for efficient decisions are removed and profit no longer reflects economic performance. Consequently, private-ownership-influence on the firm's decision-making is excluded in the regulation-by-demand design.

As will be outlined in the following, decision-making and information processing is completely based on demanders' preferences, though in varying degrees of directness. Depending on the type of decision to be made (strategic or routine, strongly utility-affecting or merely technical), the connection between the management and the actual demanders is more or less direct or general. This reflects different time horizons as well as different needs for costly information processing.

The most general guidelines for a firm's decision-making are the well-known economic efficiency rules, like marginal cost pricing and its numerous derivatives and approximations. These rules suggest decisions that can be considered optimal in the general sense of the demanders' welfare, even if the demanders never formally approved them. Unfortunately for practical purposes, these rules start with restrictive assumptions that exclude part of the real world problems

(for example quality characteristics), and the data to fill these rules are subject to information processing of parties that may systematically distort them.

Two general principles shall be noted for the institutional design:

- The system shall allow and enforce the implementation of general efficiency rules where they are applicable.
- The assumptions and information processing necessary to fit a specific situation into a general rule as well as any other discretionary decision shall be made with proper participation (direct or indirect) of all allocatively relevant objective functions.

Thus, if we establish a system of allocative rules as necessary conditions for decision-making, the discretionary freedom is restricted to the "space" between the rules. This dialectic tension between rules and discretionary freedom is a constituting element of the regulation-by-demand design.

#### Overview over the Institutional Elements

Before we describe the institutional elements and rules in greater detail, the main elements of the regulation-by-demand design shall be noted as an overview:

- the management of the firm is assigned and controlled by a demand-agency. The demand-agency also makes the strategic decisions about the production plan and governs all

discretionary decision-making in accordance with the demanders' preferences.

- the members of the demand-agency are elected in a competitive process by the demanders in order to reflect their preferences and to set an allocatively founded incentive structure for the agents.
- the demand-agency establishes appropriate information processing capacities in order to achieve efficient preference transfer.
- a specifically defined public authority supervises and enforces given quasi-constitutional rules for the institutional procedures as well as for general efficiency rules, and enacts rules in cooperation with a representative body of pertinent demand agencies.
- the main rules are part of the legal framework and not to be changed internally. They contain criteria to determine when a firm has to be released from regulation and turned "back" to private ownership.

#### Internalization Rule and Public Authority

The utility function (1) contains the price as an independent variable, but in any economy the price-cost-relation is subject to limitations given by the shortage of resources. The principle that the use of resources shall be paid for by those who consume them, is the "internalization rule," which is a necessary condition for allocation.

In a corporate environment with no externalities it means:

- in the interfirm relation it is identical with the nonnegative profit condition for the firm, and
- in the intrafirm relation it postulates cost adequate pricing and the absence of cross-subsidizing.

As ambiguities occur in the application of a general internalization rule, heuristic sub-rules are to be developed for specific industries and situations. The main rules and necessary conditions with general validity for efficient production are part of the legal framework that embeds the regulation-by-demand system into the institutional environment of the society. The compliance with these rules is supervised by a public authority. More special rules are to be enacted by this authority following a formal procedure that incorporates the participation and competence of demand agents. This participation has to be on a representative basis of all demand regulated firms that will be subject to such a rule. It has to be public and shall include independent academic wisdom.

The public authority audits the firm's bookkeeping and financial position on a regular basis (or gives the routine work to auditors) and supervises the management and the agents major decisions, if they are in accordance with the system of prevailing rules.

Since the rules are only necessary but not sufficient conditions, and since they will cover only a part of the elements of the utility functions, a great deal of discretionary decision-making

is left to the demand-agency.

The other part of the public authority's tasks is enforcing the procedural rules for electing the agents, for their decision-making within the agency, and for their information processing. Analogous to the efficiency rules above, these rules are partly given by the legal framework, and partly developed within the system. The authority determines the electorate of demanders for the voting process, sets qualification standards for the agent--candidates (and excludes them from candidacy because of their earlier severe rule violation), and settles procedural conflicts within the agency or between agency and management. Furthermore, they may act like a court of appeal for overruled minority agents to increase the pressure for consensus within the agency.

The public authority is a quasi-judicative institution with limited and defined discretionary freedom. Most of their effectiveness will stem from the agents' anticipation of their rules enforcement.

#### Public Ownership and Financing

In an environment where the profits do not reflect the firms' performance, and private ownership does not create efficient incentives, the allocative reasons for the coincidence of decision-making power with ownership become obsolete. Therefore, these are basically separated in the regulation-by-demand design. Ownership here is a second-rate issue because of this separation, and "public" ownership is chosen as the broadest and most general interpretation of

a public interest institution. In a different but similar design, the demanders might be thought of as the shareholders of the firm. This would create some of the effects of regulation-by-demand, but would incur more inflexibilities and dysfunctional effects in a dynamic industry when time passes and demand and structural conditions change.

The capital market is a pretty well functioning mechanism for allocating interest rates and returns to different risks of investments. If the firm issues bonds to finance its investments, the capital market will determine the firm's virtual costs of capital over nominal return and quotation. As the public institution enforces the internalization rule, the risks of the bonds are close to zero. If the public authority guarantees the returns on investment (like the regulatory commissions under the prevailing regulatory system practically do as well) the risks will be equal to zero. This will enable the firm to finance itself even on a hundred percent basis.

For some of the socially most important natural monopolies--the public utilities--this does not even create extra budget problems, as the political institutions would already assume responsibility for a reasonable supply of utilities. Furthermore, the public utilities generally exhibit low price elasticities, which allows internal solutions over price increases in case the returns are endangered. Therefore, the return guarantee of the public institution incurs a specific problem only, if (1) the industry exhibits high price elasticities of demand and if (2) the supply is not in a general public interest. In such a case, the authority has two instruments to cover potentially remaining risks for the returns. It can add a

quasi-insurance premium to the capital costs according to expected risks, and it can determine a higher rate of depreciation for the firms equipment. In both ways, the nominally accounted costs per unit of the product will be higher, and consequently the price will be higher. The accruing surplus in revenues builds a reserve fund in the accounting. The depreciation method is especially apt in those cases where a certain investment project of the firm serves only part of the demanders--and only those should pay for the incurred risks over the product prices. And a third method is available in cases where the potential demanders are identifiable and their number is small. In order to decrease the demand risk for the firm and the public institution, the demanders can be asked to guarantee a certain demand in advance, before a special risky investment is made.

#### The Incentive Structure of the Agents and the Management

The demand agency is responsible for all major decisions of the firm where demanders preferences are involved. Although they have been given rules to follow, they can be considered the actual decision-makers for these major decisions.

The agents are elected by the demanders in a competitive voting process. The agent's positions are well-paid to attract competent candidates. The number of votes a certain demander may cast is a positive function of the amount of pertinent products purchased (not regarding sales in not-monopolistic third markets). The necessary information about a candidate's position on central issues of the firm's policy, his professional experience and qualifications

for the job, and, for incumbent candidates, their voting behavior in former agencies, is made available to every electoral demander. For routine elections this will be sufficient, as in election times with policy controversies, interested groups will provide further information or bring up neglected issues.

If the electorate is heterogenous, the public authority will divide it into sub-electorates with a specified number of agents for each to elect. This can occur for two main reasons:

- if the information processing capacities and/or the amount of purchases per demander are very different (for example private consumers and high-demand production plants in electric utilities) in order to avoid domination of the process of powerful groups.
- if the utility functions are very heterogenous, especially if the firm provides different products (for example, if a telecommunications network is used by telephone customers as well as data transmitters or television stations).

The public authority delimits the number of candidates by defining qualification standards. In exceptional cases, it may prevent a candidacy for reasons of former severe rules infringements.

The election procedures determine the dependence of the agents on the demanders and their preferences, and consequently determine their incentive structure for decision-making. This binding to allocative objectives allows the system to give the agents discretionary freedom within the rules and within the given incentive

structure.

The assignment for the management positions (as well as the verification of the performance) is part of the agency's job. This determines the managers' incentive structure, not only for material decisions, but also for delivering the necessary technical information to the agency to make them understand the availability and costs of certain policy options. As they are not dependent upon profit oriented owners, they have no systematic incentive to distort and misrepresent the information.

#### Information Processing and the System's Results

In addition to information by market results and election results, there are other ways of getting information about demanders' preferences that are less formal but nevertheless reliable if the execution is subject to appropriate incentives. The agency's and the management's incentive structure for their information processing is the same as for their material decisions, because their performance is judged on the basis of the demanders' preferences. Additionally, some information processing to evaluate preferences is required by the rules and legal framework. As the demanders' capacities are considered low, the agency's questions have to be simple and they must not require informational efforts. This can be market research type questionnaires on a smaller or larger sample basis about central issues of the production plan, or preference judgments on alternatively feasible product characteristics. Another important aspect for identifying preferences is the proper handling of

demanders' complaints and proposals. The effectiveness of such signals in the system determines the incentives for such an articulation.

But do the demanders represent their preferences correctly?

In a natural monopoly a demander is locked into one supplier, whose decisions on product characteristics determine the demander's utility function. Any misrepresentation of his preferences in information processing will therefore deteriorate his position. Even if there are no incentives for misrepresentation, incentives for participating at all in pertinent information processing may be still too low in some cases. This could be if a large number of demanders is involved and the relevance for each demander is relatively small. This is represented by low EAVI-values in Figure 10. The occurrence of dissatisfaction with the firm's performance will result in a higher EAVI and create incentives for participation in information processing. Beyond trifle matters, the response in a regulation-by-demand system will be relatively strong, which is indicated in  $S_{RD}$  in Figure 10.

For the results in the simple case where the preferences of the demanders can be represented by one set of convex iso-utility lines  $\beta_1, \beta_2$ , see Figure 11. Because of the described information processing and incentive structure, the demanders' preferences are (at least in their relevant parts) known to the agents and the management. The management has no incentive to misrepresent the hypothetical cost functions for different production plans, nor has the agency to realize any other point than the most efficient,  $R_{RD}$ . This point will

FIGURE 10

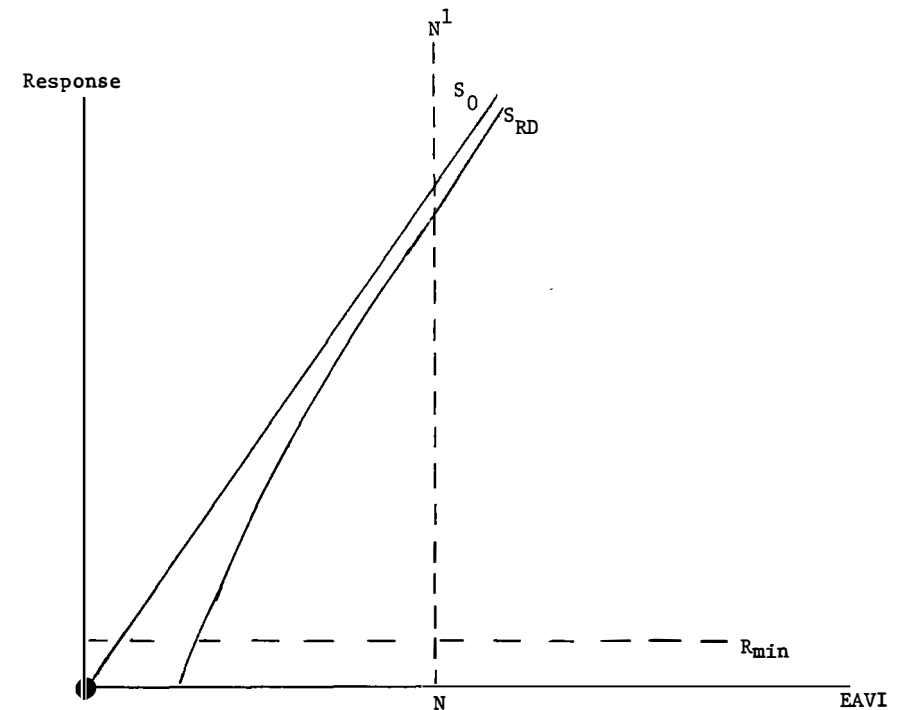
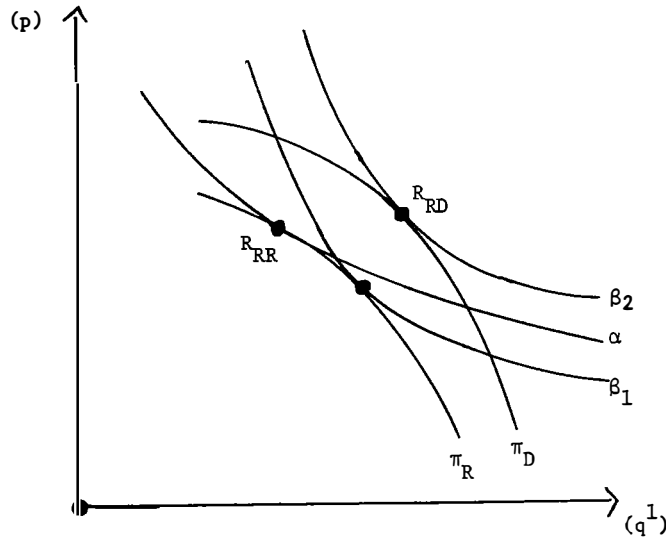


FIGURE 11



be more efficient than  $R_{RR}$  which is the comparable rate of return point ( $U(\alpha) < U(\beta_1) < U(\beta_2)$ ), because

- the cost slack will be significantly smaller,
- there is no systematic input distortion,
- the "profit" is equal to the actual cost of capital, and
- the  $\pi$  and  $\beta$ -functions are more reliably "right".

The more difficult case where the preferences are too heterogenous to be relevantly represented by one set of convex iso-utility lines requires more analysis and procedural discussion than can be given here. Therefore, without institutional details, the following description may seem somewhat speculative. But it shall be noted that the agencies' internal procedures under their most awkward preference conditions do have generally the same properties and problems as most of the political commissions and committees, with one important difference: they are more closely bound to their voters' preferences structures, which they know better, and which are still simpler than those in political electorates. And, of course, the same kind of decisions would have to be made under any institutional design.

The electorates and the election procedures are designed to have the different preference structures represented in the agency. The problem-solving and decision-making within the agency are subject to strong pressures for consensus, and involve more information processing the more heterogenous preference structures are: as the information concerning preferences and the firm's cost functions are



available to every agent and the public authority, monopolizing the information processing to develop policy options is impossible. If a first approach to a certain decision problem does not come out with a broad consent, the group that expects to win the majority on this issue will nevertheless hesitate to use its power. They anticipate that the minority group will check if the solution complies with the necessary conditions. This has two effects on the discussion itself. First, economic efficiency principles will be the central issue in the agency's discussion and the pertinent data will be searched. Second, the majority group will be inclined to make concessions before they use their voting power to avoid delay by interference of the public institution and to maintain readiness for consensus for the issues to come.

#### Institutional Flexibility

Regulatory designs are made for the special economic conditions of natural monopolies. These conditions are subject to change. The average cost curve may be due to technical changes and the demand curve may shift, with the result that the industry loses its natural monopoly properties. Such an occurrence will postulate institutional transition back to competition. Let's consider that a demand-regulated firm has lost its natural monopoly properties and this is expected to be permanent. The firm then is threatened by market entry of new competitors. New firms will anticipate that the demanders do not have incentives to stick to the old firm if they offer competitive products. Market entry will be more likely with

heterogeneous preferences and rapid technical progress, because it increases the new firm's chance of successfully offering quality-varied products and competitive prices. The absence of a regulatory umbrella that prevents entry provides information about intermodal relations and new technological feasibilities much earlier, because prevailing regulation discourages potential entrants to disclose new conditions. The availability of competition ends the legitimization of regulation and public ownership. The demand-regulated firm will be turned "back" into private ownership by sale or emission of stocks. The demand agency will be "supplanted" by a board of directors to control the management. In order to maintain efficient incentives before and continuity after the transition, the agents and demanders may be entitled to buy stocks for prices according to the capital invested (sum of bonds and loans divided by the number of stocks).

The starting of such a transition back to competition is subject to criteria defined within the legal framework of regulation-by-demand. It does not depend upon a discretionary political decision which is typically dominated by distributional rather than allocative arguments.

The establishing of regulation-by-demand follows several steps:

1. The public authority determines if a firm has natural monopoly properties and if this makes it subject to regulation, according to given criteria.
2. It declares some major decisions (investments, prices, returns) of the firm to be subject to its approval.

3. Elections for the demand agency are held. The authority entitles them to decision competence, except on prices and returns.
4. Bonds for financing and re-capitalizing are emitted.
5. The old stock will be exchanged in return for bonds, including an extra-profit for old investments.
6. The demand agency is given full regulation-by-demand decision competence.

The reason for a profit for old investments exceeding the bond return is the maintenance of incentives for the firm in the pre-transition period. The returns on new investments equal the capital market returns for comparable investments, which is also the condition for a theoretically "fair rate of return".

#### FOOTNOTES

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